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TECHNICAL ASSISTANCE PROGRAM

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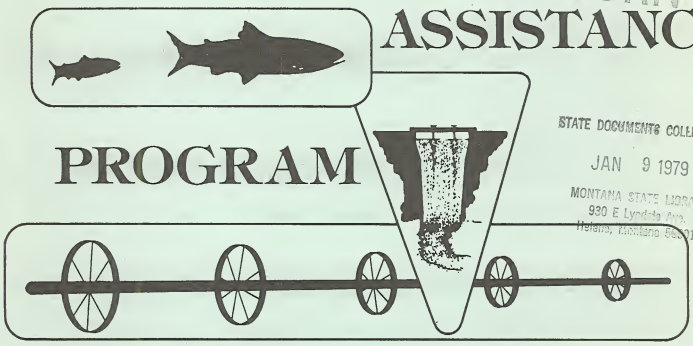

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Prefeasibility Report
on

MADISON CONSERVATION DISTRICT
Dry Lake Project

79-7

MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION
WATER RESOURCES DIVISION
NOVEMBER 1978
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TECHNICAL ASSISTANCE PROGRAM

Madison Conservation District
DRY LAKE PROJECT

Prepared By:

Norm Barnard, Civil Engineer
Bill Long, Resource Economist

Department of Natural Resources and Conservation
Water Resources Division
32 S. Ewing
Helena, Montana
449-2872

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INTRODUCTION

The Madison Conservation District contacted the Department of Natural Resources and Conservation in October 1977 to request technical assistance through the Department's Technical Assistance Program (TAP), designed to implement water resources projects. TAP assists local groups by providing prefeasibility reports on multipurpose water and related land use projects. Such a report was requested to determine the possibility of developing a gravity sprinkler system from Dry Lake.

EXISTING PROJECT

Dry Lake is a man-made reservoir located in Madison County (figure 1), about two miles north and one mile east of Pony, Montana. The project can be reached by leaving Highway 287 at Harrison, traveling west to Pony, and then taking a county road northeast.

The project includes land in T. 1 S., R. 2 W. The point of diversion is in the SE¼ of section 18, T. 2 S., R. 2 W. The reservoir is located on the section line between sections 4 and 5 T. 2 S., R. 2 W. Project lands are located in both townships, generally east of the reservoir, in figure 1.

Existing structures include a supply canal, reservoir, and outlet canal. The supply canal carries water from Willow Creek at the town of Pony about three miles to the reservoir, which is formed by an earth-fill dam thirteen feet high and 620 feet long. Water surface area is sixty-three acres; the reservoir contains 328 acre-feet of storage for irrigation. The drainage area above the reservoir is about two hundred acres. The present reservoir supplies water to three users through a four-mile canal; all three users would be included in the proposed project.

PROPOSED DEVELOPMENT

The project plan was developed by combining information previously collected by the SCS and the water users with data developed by the TAP staff. No attempt was made to determine the availability of a firm water supply. This would depend to a great extent on the willingness of the users to consolidate their water rights and file for a change in point of diversion.

The proposed project would consist of (1) a storage structure and (2) a distribution system. The supply canal and diversion structure to the reservoir would have to be enlarged to accommodate relatively large flows of 1000-1500 cubic feet per second (cfs) to take advantage of spring run off. The normal flow in the canal during the early part of the irrigation season would vary from 300-400 cfs. The system was designed to supply water to 1740 acres.

Present reservoir capacity would be increased from 328 to 1700 acre-feet by raising the embankment height to twenty-five feet and constructing a dike across a draw on the northwest side of the reservoir. An additional ten feet of embankment would be required for freeboard. The amount of fill required would be 119,000 cubic yards for the thirty-five foot dam embankment and 10,000 cubic yards for the dike. A spillway through the dike would be constructed and an outlet into a canal made through the dam.

The distribution system would consist of an unlined canal and a mainline distribution pipe (figure 2). The unlined canal, 3700 feet long, would carry thirty cfs. A transition structure would divert the canal flow into the mainline distribution pipe of reinforced concrete. Pipe diameter would range from thirty-six inches down to sixteen inches with seven main turnouts. Booster pumps would be required at the first four turnouts to bring the pressure up to operating level. Branch lines would be connected to these turnouts for distribution to sprinkler laterals.

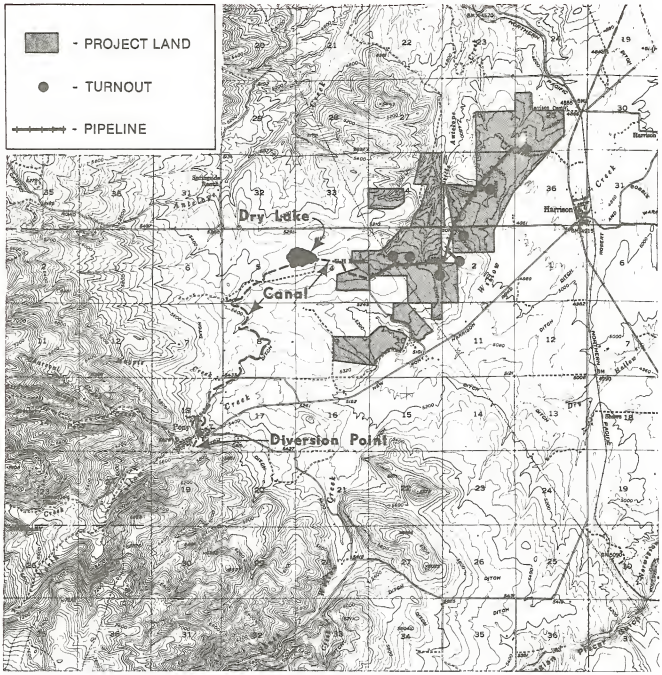

Figure 1. Location of Dry Lake Project.

PROJECT COST ESTIMATE

Direct Costs.

Costs (Appendix) for the proposed systems were estimated from similar projects and prices from irrigation equipment suppliers. Land rights costs were determined by multiplying the surface area of the reservoir (150 acres) plus 10 percent, for right of way around the reservoir, by $200 per acre, a figure obtained from Cooperative Extension Service data for the area. DNRC was informed that half of the above land area was available to the project at no additional cost. This resulted in a total land rights cost of $15,000

The cost of construction requirements for the supply canal which would include restructuring the diversion and widening the canal, was derived from a bid from one of DNRC's state-owned water projects and the assumption that a major portion of the work would be done at the local level. A contour map developed by the Soil Conservation Service was used to estimate the yardage requirements for the dam and dike embankment. The costs for the outlet, spillway, and earthwork were estimated from an average cost for several projects. The existing dam which is not keyed into bedrock would have to be removed; the cost of removal was included as part of the dam embankment costs. Even though the dike would be structurally simpler to construct than the dam, the unit cost would remain about the same because of the smaller volume involved. The total cost of the structural improvements to the reservoir was estimated at $440,000.

As shown on figure 2, the water leaving the reservoir through the outlet tunnel would be carried 3700 feet by canal before beginning the drop through the pipe that would give the water gravity pressure. The cost of the canal would be much less than the cost of pipe for the same section, and there would be no advantage to piping the water the first 3700 feet, since only minimal gravity head would be gained. The cost of this outlet canal would be $10,000 assuming most of the construction work would be done at the local level.

The main pipeline would contain the water and develop pressure head as it distributed water to the turnouts. The cost of reinforced concrete pipe for the main line was updated from Bureau of Reclamation sources; total cost of pipe would be $460,000. The cost of burying the pipe was not included, since doing so is not absolutely necessary and government programs could probably be used to defer this cost. At the first four turnouts, booster pumps would bring the operating pressure up to 85 pounds per square inch, high enough to include allowances for pressure losses in branch and lateral lines. One 100-hp, one 50-hp, and two 25-hp pumps would be required, for a total cost of $10,000. This cost could have been included in the typical on-farm budgets; however, it was included as part of the project costs since the net effect on ability to pay or total project cost would yield the same result.

The total cost of the distribution system is $480,000.

The total direct cost for the entire project would be $935,000.

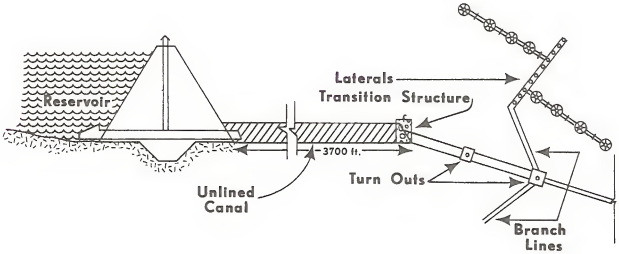

Figure 2. Schematic of Dry Lake Project. (no scale)

Indirect Costs.

The indirect costs would consist of engineering services, contingencies, and interest during construction. Engineering services--design, bid-letting, contract administration, and construction inspection--were calculated at 15 percent of total direct cost, or $140,000. This cost might be paid by the U.S. government if the Soil Conservation Service (SCS) did the engineering. However, the Madison Conservation District does not have an agreement for technical service assistance with the SCS. Contingencies were assumed to be 20 percent of total direct cost plus engineering services, or $215,000.

The 2½ percent used to estimate interest during construction was based on 10 percent interest over a six-month construction period, with an average balance of half the sum of direct costs, engineering services, and contingencies. The total interest calculated was $32,000; the total of all indirect costs was $387,000.

Total Costs.

The sum of all of the above costs would be the total project cost, $1,322,000. Amortized at 7 percent interest over forty years, the project would cost $99,162 annually.

Since the project has been designed for 1740 acres, the annual cost per acre is $56.99. This cost per acre will not change substantially with slight increases or decreases in total acres.

FARM BUDGETS

Farm budgets were estimated for the 1,740-acre project based upon data supplied by the ranchers involved and the Montana Cooperative Extension Service. For this analysis, it was assumed that 75 percent of the land would be in alfalfa production and 25 percent in small grains, in this case, barley. On-farm irrigation costs were for branch lines, individual sprinkler systems, and appropriate hardware. It was assumed that one quarter-mile sprinkler lateral would be required for every forty acres. The on-farm budgets are presented in the Appendix.

Yields were assumed to be ninety bushels per acre for barley and four tons per acre for alfalfa, resulting in a net income of $54,179.25 for the project acreage. Per acre, the water users would be able to pay $31.14 for water, or $15.57 per acre-foot (water requirements for sprinklers are two acre-feet per acre).

Since some profit is probably made now on the project land, the project users are likely to be willing to pay less than this amount for the project.

CONCLUSIONS

Because the project would cost $56.99 per acre for water and the users' ability to pay would be only $31.14 per acre, the project is economically infeasible at this time. Additionally, no operation and maintenance costs for the main system, electrical expenses for the booster pumps or pipe burial costs were included in these estimates due to the economically marginal nature of the project with readily quantifiable costs. The estimates reflect work which would have to be done at the local level. If grant monies for more than 45 percent ($595,000) of the total project cost were obtainable, the users' ability to pay would equal the annual project costs. At some future date, the revenue from agricultural commodities may warrant a second feasibility appraisal for this project. DNRC will maintain a file on the information used in this prefeasibility report which will be available to interested parties.

APPENDIX

PROJECT COSTS

DIRECT COSTS				
Land Rights	$ 15,000			
		$ 15,000		
Reservoir Structures				
Supply Canal	$ 10,000			
Dam	400,000			
Dike	30,000			
		$440,000		
Distribution System				
Outlet Canal	$ 10,000			
Reinforced Concrete Pipe	460,000			
Booster Pumps	10,000			
		$480,000		
TOTAL DIRECT COSTS			$ 935,000	
INDIRECT COSTS				
Engineering Services (15%)		$140,000		
Contingencies (20%)		215,000		
Interest During Construction (2.5%)		32,000		
TOTAL INDIRECT COSTS			$ 387,000	
TOTAL PROJECT COSTS				$1,322,000

$1,322,000 amortized at 7% interest over 40 years yields $99,162 annually

or $56.99 per acre.

TYPICAL FARM BUDGETS

IRRIGATED HAY

Variable Costs (per acre)

Fertilizer and Application	$ 17.46
Stand Establishment	1.55
Tear out Alfalfa	5.19
Machinery	10.27
Pickup	3.00
Miscellaneous	5.97
Interest on Operating Capital	.75
Machinery Labor	6.97
Sprinkler	3.93
Total Variable Costs	$ 55.09

Fixed Costs (per acre)

Irrigation System	$ 28.86
Taxes and Insurance	3.65
Storage	2.73
Machinery	27.46
Land	35.00
Total Fixed Costs	$ 97.70
Total Costs (per acre)	$152.79

IRRIGATED BARLEY

Variable Costs (per acre)

Seed	$ 6.00
Fertilizer	25.70
Crop Chemical	2.55
Custom Hire	13.88
Machinery	7.54
Pickup	3.00
Miscellaneous	4.61
Interest on Operating Capital	1.29
Machinery Labor	6.69
Sprinkler	3.93
Total Variable Costs	$ 75.19

Fixed Costs (per acre)

Irrigation System	$ 28.86
Taxes and Insurance	3.65
Storage	2.73
Machinery	20.15
Land	35.00
Total Fixed Costs	$ 90.39
Total Costs (per acre)	$165.58

ABILITY TO PAY FOR WATER (PER ACRE)

Gross Income

435 acres barley @ 90 bu. @ $1.65	$ 64,597.50		
1305 acres alfalfa @ 4 ton @ $50	261,000.00		
Total Gross Income		$325,597.50	

Gross Expenses

435 acres barley @ $165.58	72,027.30		
1305 acres alfalfa @ $152.79	199,390.95		
Total Gross Expenses		$271,418.25	
Net Income			$ 54,179.25
Net Income per acre (54,179.25 ÷ 1740)			$31.14